SIMPLIFIED LESSONS ON PROPER CARE OF AUTOS

Technical Terms Applied to Ignition System Are Made Clear by The Times-Dispatch Expert.

EXPLAINS ELECTRICITY LAWS

Materials Through Which Electrical Current Cannot Pass—How the Dry Cell Operates—Knotty Auto Questions Are Answered.

FOURTH LESSON.
Ignition.

We now come to the study of the ignition systems, that is, of the devices which are used to ignite the explosive compressed mixture of gas and air, which we have in the cylinders.

In the automobile this is accomplished by the utilization of some of the well-known properties and action of an electric current. To understand the ignition system, therefore, we must know some of the simple laws of electricity, and I will first explain these laws and what the various terms used so often mean.

By comparing the flow of an electrical current through a wire, to the flow of water through a pipe, I believe I can more readily make you understand these laws and terms.

The Volt and Ampere.

First of all, if you had a line of pipe with a water motor or other water-operated device at one end, and you wanted water to flow through this pipe, you would have to have some pressure at the source to force it through. If you knew what the pressure were you would say that it was a certain number of pounds. So, likewise, to have a current of electricity flow through a wire, electric motor or other electrically-operated device, you would have to have a pressure at the source to force the current through. An electrician would say that the current had a certain number of "volts" pressure. The volt, therefore, is the unit of measure of electrical pressure.

This should explain to you the terms high voltage or low voltage, they mean high pressure or low pressure.

It might be well to explain to you here that, while tension means pull, and, therefore, the opposite of pressure, that high tension and high voltage really meant the same thing when used in defining an electrical current. While the current under pressure above referred to must come from the source of current, that is, the battery, dynamo, etc., it must also, after having done the things required of it, return to this source. We might, therefore, instead of saying it is pressed out from the one side, say that it is drawn or pulled, sort of sucked, into the return side. Thus it will be under a pull or tension, instead of pressure.

What does the ampere, or amperage, mean? Referring again to our pipe, with water flowing through it, if you wanted to know how much was passing through during a minute, say, you would put a meter in the line and measure the number of gallons. So, likewise, you can measure the amount of current passing through a wire, but instead of saying gallons, the electrician says amperes, or that the current has a certain amperage.

Thus the ampere is the unit of measure of the electrical rate of flow, or of the quantity flowing.

There are certain materials, such as rubber, mica and porcelain, through which an electrical current cannot pass, likewise there are materials through which it can pass freely. The former we call non-conductors, or insulating materials; the latter conductors.

The Spark.

Here, I believe, is the place to explain the electrical action, which more than any other is used to give the spark by which the gases are ignited.

Coming back to water, if we had a pipe with water under a low pressure in it, we could fasten a piece of cardboard to the end of this pipe, and it would stop the flow of the water; but if we raised the pressure of the water sufficiently, it would burst through this cardboard, probably with a loud report. Of course, the thicker the cardboard the greater would have to be the pressure.

Air will act much the same in stopping the flow of electricity as the cardboard does that of water. Thus a thin layer of air will resist the flow of electricity under a low pressure, but if the pressure, or voltage, be raised sufficiently, the electricity will burst through this layer of air, and, in doing so, will cause a spark to be produced.

It is the above action which is used to give the spark required to ignite the gasoline mixture in the cylinder of the engine.

Examine now a spark plug. You will notice that the portion of the plug which is screwed into the cylinder has attached to it a small piece of wire, or a number of small points, which are about 1-64 to 1-32 of an inch from another wire. This last wire runs through a piece of porcelain, mica or other non-conducting material, so as to be insulated from the portion of the plug screwed into the cylinder, the other end having a screw by which the wire carrying the current can be fastened to it.

If now we connect a wire to the cylinder and another to the screw above mentioned, and then send a current of electricity under a high pressure through this wire, the current will go through the porcelain insulated wire until it comes to the 1-64" or 1-32" air space and then burst or jump across this space, giving a spark as it does so. It will then go through the iron of the cylinders to the wire which is connected to them.

The pressure or voltage required to cause the current to break through, or jump across the air gap, must be extremely great, far greater than it is practical to carry enough batteries; or large enough generator or dynamo, to give. Fortunately, the induction coil, which will be explained later, can be used to convert a low voltage current into one of high voltage.

There are three methods used in the automobile to obtain the electrical current; namely, the dry cell, which is a device by which the current is made due to a chemical action; the storage battery, a device by which the current from some other source is stored up, to be used at will; the magneto and generator or dynamo, by which some of the energy of the engine is converted into electricity.

The magneto we will take up separately, while the storage battery and generator will be taken up with the starting and lighting systems.

The Dry Cell.

A dry cell usually has an outer shell made of zinc, next to which are placed a number of layers of blotting paper, saturated with a solution of salammoniac and water. In the center is a piece of carbon, the space between this and the blotting paper being filled up with either coke or sawdust. The top of the battery is then sealed.

If a wire is connected to the inner carbon, then run to the units where current is required, and then back to the zinc of the battery, a current having a pressure of about 1 1-2 volts will, due to a chemical action between the zinc and the solution in the blotting paper, flow from the carbon through the units and return to the zinc.

The current coming from the carbon, we say it is the positive pole and the screw for fastening the wire to it the positive terminal, while the zinc, to which the current returns, is the negative pole, and its screw the negative terminal. I might say here that in all devices which give electrical current, the terminal from which the current flows is called the positive, usually marked (+), while the one to which the current returns is called the negative, and is usually marked (—).

A dry cell will yield a current having a pressure of 1 1-2 volts, this pressure not being affected by its size, as a small vest-pocket cell will have the same voltage as one of the size of a barrel would have. The quantity, or amperage, of current, however, will vary with the size, the standard size cell when fresh giving from 20 to 25 amperes.

To increase the voltage (the usual voltage for automobile ignition systems is about six) we connect in series—that is, we connect the positive terminal of one cell to the negative of another, the positive of the second to the negative of the third, and so on. The diagram shows such a connection.

To increase the amperage, we connect in multiple—that is, all of the negatives and all of the positives connected together. This will increase the amperage, but the voltage will be the same as that of one cell, or 1 1-2.

To increase the voltage and the amperage, we first connect up two sets of cells in series, each set to give the required voltage, and then connect these sets in multiple.

The diagram shows these three connections.

(Continued on Tenth Page.)

Diagram of Automobile Ignition Systems